<u>In the Claims:</u>

Please amend the claims as follows:

1. (Cancelled) An apparatus for testing functionality, evaluating performance and measuring capacitance of a photo-conversion device of at least one active pixel sensor of an array of active pixel sensors comprising a column bus, a signal conditioning and readout circuit and a chain of circuitry connected to said active pixel sensors comprising:

a test voltage selection circuit for selectively applying any of a plurality of voltage levels that vary incrementally from a first voltage level to a second voltage level to a reference distribution node of the active pixel sensors; and

a timing control circuit connected to the test voltage means, to said array of active pixel sensors, and to a signal conditioning and readout circuit to provide signals to select timings to select application of the first voltage level and the second voltage level to the reference distribution node of said active pixel sensors, signals at appropriate timings to condition said active pixel sensors in preparation for sensing light impinging upon said array of active pixel sensors, and providing signals for timing said signal conditioning and readout circuit to sense a signal from each active pixel sensor indicating a magnitude of light impinging upon said array of active pixel sensors.

2. (Cancelled) The apparatus of claim 1 wherein said test voltage selection circuit comprises:

a first switch having a first terminal connected to a first voltage source that provides said first voltage level, a second terminal connected to the reference distribution node of at least one active pixel sensor on a row of active pixel sensors, and a control terminal connected to the controlling means to selectively connect and disconnect the first terminal with the second terminal;

a second switch having a first terminal connected to a second voltage source that provides said second voltage level, a second terminal connected to the reference distribution node of at least one active pixel sensor on the row of active pixel sensors in the array of active pixel sensors, and a control terminal connected to the controlling means to selectively connect and disconnect the first terminal with the second terminal; and

a current measuring device connected so as to measure a current flowing from said first voltage source.

3. (Cancelled) The apparatus of claim 1 wherein the timing control circuit enables measurement of the capacitance of the photo-conversion device within one active pixel sensor by the steps of:

at a first time, selecting said active pixel sensor;

at a second time, placing the second voltage level at the reference distribution node of said active pixel sensor;

simultaneously, at the second time, coupling said second voltage level to the photo-conversion device;

at a third time, applying the first voltage level to the reference distribution node;

simultaneously, at the third time, coupling said first voltage level to said photo-conversion device;

measuring a current flowing to said photo-conversion device to charge the capacitance of the photo-conversion device, whereby said capacitance is determined by the formula:

$$C_{FD} = \frac{I}{dV/dt}$$

where

C_{FD} is the total capacitance of the photo-conversion devices and the parasitic capacitance of said test voltage select means,

I is the current flowing from said first voltage source,

dv is the difference between the first voltage level and the second voltage level, and

dt is a charging time for said capacitance;

4. (Cancelled) The apparatus of claim 1 wherein the timing control circuit enables testing functionality of a row of said active pixel sensors within the array of active pixel sensors and the chain of circuitry connecting said selected row of active pixel sensors by the steps of:

at a first time, selecting said row of active pixel sensors;

at a second time, placing one of the plurality of voltage levels on each reference distribution node of each active pixel sensor, whereby a magnitude of said voltage level placed on each reference distribution node is indicative of a position on said row of active pixel sensors of each active pixel sensor;

simultaneously, at the second time, coupling the voltage level of the plurality of voltage levels to the photo-conversion device to charge the capacitance of the photo-conversion device to the voltage level;

at a third time, sampling and holding the voltage level of the capacitance of ach active pixel s nsor on the selected row of active pixel s nsors within the signal conditioning and readout circuit;

at a fourth time, placing the first voltage level at the reference distribution node of each active pixel sensor on the row of active pixel sensors;

simultaneously, at the fourth time, coupling said first voltage level to the capacitance of the photo-conversion device of each active pixel sensor of the row of active pixel sensors;

at a fifth time, sampling and holding the first voltage level on the capacitance of the photo-conversion device of each active pixel sensor on the selected row of active pixel sensors within the signal conditioning and readout circuit;

placing the sampled and held voltage level of the plurality of voltage levels and the sampled and held first voltage level of each active pixel sensor of the selected row of active pixel sensors at an output port of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external circuitry differentially compares the sampled and held voltage level of the plurality of voltage levels with the sampled and held first voltage level and the functionality of each active pixel sensor on the selected row of active pixel sensors, and th chain of circuitry connected to each active pixel sensor of th row of active pix l sensors

is determined as a function of a difference between the sampled and held voltage lev l of th plurality of voltage levels and the sampled and held first voltage level.

5. (Cancelled) The apparatus of claim 1 wherein the timing control circuit enables evaluating performance of at least one active pixel sensor and the chain of circuitry connected to said active pixel sensor by the steps of:

at a first time, selecting the active pixel sensor;

at a second time, placing the second voltage level at the reference distribution node of the active pixel sensor;

simultaneously, at the second time, coupling said second voltage level to the capacitance of said photo-conversion device;

at a third time, sampling and holding the second voltage level within the signal conditioning and readout circuit;

at a fourth time, placing the first voltage level at the reference distribution node of said active pixel sensor;

simultaneously, at the fourth time, coupling said first voltage level to the capacitance of the photo-conversion device;

at a fifth time, sampling and holding the first voltage level from said capacitance of said photo-conversion device of said active pixel sensor to the signal conditioning and readout circuit; and

placing the sampled and held first voltage level and the sampled and held second voltage level at an output of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external circuitry differentially compares the sampled and held first voltage level and the sampled and held second voltage level such that the difference of the sampled and held first voltage level and the sampled and held second voltage level determines performance of the active pixel sensor.

6. (Cancelled) The apparatus of claim 1 wherein the test voltage selection circuit comprises:

a first voltage distribution line containing a first distribution voltage level;

a second voltage distribution line containing a second distribution voltage level;

a first switch having a first terminal connected to a first voltage source that provides the first voltage level, a second terminal connected to the first voltage distribution line, a third terminal connected to the second voltage distribution line, and a control terminal connected to the timing

and control means to selectively connect the first terminal to the second and third terminals concurrently;

a second switch having a first terminal connected to a second voltage source that provides the second voltage level, a second terminal connected to the first voltage distribution line, a third terminal connected to the second voltage distribution line, and a control terminal connected to the timing and control means to selectively connect the first terminal to the second and third terminals concurrently;

a third switch having a first terminal connected to the first voltage source, a second terminal connected to the second voltage source, a third terminal connected to the first voltage distribution line, a fourth terminal connected to the second voltage distribution line, and a control terminal connected to the timing and control means to selectively connect the first terminal to the third terminal and concurrently connect the second terminal to the fourth terminal;

a voltage dividing means connected between the first voltage distribution line, and connected to the reference distribution node of each active pixel sensor on a row of active pixel sensors for the array of active pixel sensors for distributing an incremental voltage level that varies fractionally from the first distributed voltage level present at the first

voltage distribution line to the second distributed voltage level present at the second voltage distribution line; and

a current measuring means connected so as to measure current flowing from said first voltage source.

7. (Cancelled) The apparatus of claim 5 wherein the timing control circuit enables measurement of the capacitance of the photo-conversion device within a group of active pixel sensors of the array of active pixel sensors by the steps of:

at a first time, selecting said group of active pixel sensors;

during a period of time between a second time and a third time, activating said second switch to connect the first terminal of the second switch to connect the second terminal and third terminal of said second switch to apply the second voltage level to the first and second voltage distribution lines and thus to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period between said second time and said third time, coupling said second voltage level to the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to charge said capacitance to said second voltage level;

during a period of time between a fourth time and a fifth time, activating said first switch to connect the first terminal of said first switch concurrently to the second and third terminals of said first switch to apply the first voltage level to the first and second voltage distribution lines and thus to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period between the fourth and fifth time, coupling said first voltage level to the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to charge said capacitance of said photo-conversion device to the first voltage level;

measuring a current flowing from said first voltage source to charge the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors, whereby a total capacitance of the photo-conversion devices of the group of active pixel sensors and a parasitic capacitance of said test voltage select means is determined by the formula:

$$C_T = \frac{I_T}{dV/dt_{CT}}$$

where

C_T is the total capacitance of the photo-conversion devices and the parasitic capacitance of said test voltage select means,

I_T is the current flowing from said first voltage source,

dv is the difference between the first voltage level and the second voltage level, and

dt_{CT} is a charging time for the total capacitance;

during a period of time between a sixth time and a seventh time, activating said second switch to connect the first terminal of the second switch to connect the second terminal and third terminal of said second switch to apply the second voltage level to the first and second voltage distribution lines and thus to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

during a period of time between an eighth time and a ninth time, activating said first switch to connect the first terminal of said first switch concurrently to the second and third terminals of said first switch to apply the first voltage level to the first and second voltage distribution lines and thus to the reference distribution

node of each active pixel sensor of the group of active pixel sensors;

measuring a current flowing from said first voltage source to charge the parasitic capacitance of said test voltage select means is determined by the formula:

$$C_P = \frac{I_P}{dV/dt_{CP}}$$

where

C_P is the parasitic capacitance of said test voltage select means,

I_P is the current flowing to the parasitic capacitance C_P during charging from the second voltage level to the first voltage level,

dv is a difference between the first voltage level and the second voltage level, and

dt_{CP} is a charging time for the parasitic capacitance,

such that an average capacitance of the photo-conversion device of each of said active pixel sensors of said group of active pixel sensors is determined by the formula:

$$\overline{C_{FD}} = \frac{C_T - C_P}{n}$$

where

$\overline{C_{FD}}$ is the average capacitance of the photodiode,

C_T is the total capacitance,

C_P is the parasitic capacitance, and

n is a number of active pixel sensors of the group of active pixel sensors.

8. (Cancelled) The apparatus of claim 6 wherein the timing control circuit enables testing functionality of a group of at least one active pixel sensor by the steps of:

at a first time, selecting said group of active pixel sensors;

during a period of time between a second time and a third time, activating said third switch to apply said first voltag level to said first voltage

distribution line and to apply said second voltage level to said second voltage distribution lin such that one of the incremental voltage levels is applied to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period between the second and third time, coupling said incremental voltage level to the capacitance of the photo-conversion device of each active pixel sensor to the row of active pixel sensors to charge said capacitance of the photo-conversion device to the incremental voltage level;

during a period of time between a fourth time and a fifth time, sampling and holding within the signal conditioning and readout circuit the incremental voltage level present on the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pixel sensors;

during a period of time between a sixth time and a seventh time, activating said first switch to apply the first voltage level to the first voltage distribution line and the second voltage distribution line to place the first voltage level at the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period of time between the sixth time and the seventh time, coupling said first voltage level from the reference

distribution node to the capacitance of the photo-conversion device of each activ pixel sensor of th group of active pixel sensors to charge said capacitance of the photo-conversion device from said incremental voltage level to said first voltage level;

during a period of time between an eighth time and a ninth time, sampling and holding within the signal conditioning and readout circuit said first voltage level present on said capacitance of said photo-conversion device of each active pixel sensor of the group of active pixel sensors;

placing the sampled and held incremental voltage level present of the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pixel sensors and the sampled and held first voltage level of each of the active pixel sensors of the group of active pixel sensors at an output port of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external circuitry differentially compares said sampled and held increment voltage level and said first voltage level, thus determining the functionality of each active pixel sensor of the group of active pixel sensors, and the chain of circuitry connected to each active pixel sensor of the group of active pixel sensors is determined as a function of a difference between the sampled and held incremental voltage level and the sampled and held first voltage level.

9. (Cancelled) The apparatus of claim 6 wherein the timing control circuit enables evaluating performance of a group of at least one active pixel sensor of the array of active pixel sensors by the steps of:

at a first time, selecting said group of active pixel sensors;

during a period of time between a second time and a third time, activating said second switch to apply said second voltage level to said voltage distribution line such that said second voltage level is applied to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period of time between the second and third time, coupling said second voltage level to the capacitance of the photo-conversion device of each active pixel sensor to the row of active pixel sensors to charge said capacitance of the photo-conversion device to the second voltage level;

during a period of time between a fourth time and a fifth time, sampling and holding within the signal conditioning and readout circuit the second voltage level present on the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pixel sensors;

during a period of time between a sixth time and a seventh time, activating said first switch to apply th first voltag lev l to th first voltage distribution line and the second voltage distribution line to place the first voltage level at the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period of time between the sixth time and the seventh time, coupling said first voltage level from the reference distribution node to the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to charge said capacitance of the photo-conversion device from said incremental voltage level to said first voltage level;

during a period of time between an eighth time and a ninth time, sampling and holding within the signal conditioning and readout circuit said first voltage level present on said capacitance of each active pixel sensor of the group of active pixel sensors;

placing the sampled and held second voltage level present on the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pixel sensors and the sampled and held first voltage level of each of the active pixel sensors of the group of active pixel sensors at an output port of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external

circuitry differentially compares said sampled and held second voltage level and said first voltage lev l, thus d termining performance of ach active pixel sensor of the group of active pixel sensors and of the chain of circuitry connected to each active pixel sensor of the group of active pixel sensors is determined as a function of a difference between the sampled and held incremental voltage level and the sampled and held first voltage level.

10. (Cancelled) The apparatus of claim 9 wherein evaluating performance of each active pixel sensor of the group of active pixel sensors includes evaluating range and linearity of each active pixel sensor and the chain of circuitry connected to active pixel sensor.

11. (Cancelled) The apparatus of clam 6 wherein the group of active pixel sensors is a row of active pixel sensors placed in an area of dark pixels of the array of active pixel sensors.

12. (Cancelled) A photo-imaging integrated circuit comprising:

containing said an array of active pixel sensors arranged in rows and columns whereby each active pixel sensor comprises:

a photo-conversion device which converts light impinging upon said photo-conversion device to electrons which are retained at a capacitance of said photo-conversion device,

a reset reference means connected to said photo-conversion d vice to selectively apply a reference voltage level to said photo-conversion device,

a reference distribution node connected to the reset reference means reference voltage level,

a source follower means connected to the photo-conversion device to provide an output voltage level at an output terminal approximating a voltage present on said photo-conversion device, and

a pixel selecting means connected to the source follower means to activate said source follower means to transfer the output voltage level to said output terminal;

a test voltage selection means connected to at least one active pixel for selectively applying any of a plurality of voltage levels that vary incrementally from a first voltage level to a second voltage level to the reference distribution node of the active pixel sensors;

a plurality of column bus means connected such that each column bus means is connected to each output terminal of each active pixel sensor of each column of active pixel sensors;

a plurality of signal conditioning and readout circuits, whereby each signal conditioning and readout circuit is connected to each column bus means to sample and hold the output voltage level at the output terminal of a selected active pixel sensors of a row of active pixel sensors, and in response to said output signal provide a first and second sampled and held output signal; and

a timing and control means connected to the array of active pixel sensors, the test voltage selection means and the plurality of signal conditioning and readout circuits to provide timing and control signals that select active pixel sensors to transfer signals to the column bus and thence to the signal conditioning and readout circuits, and to provide the first and second sampled and held readout signals.

13. (Cancelled) The photo-imaging integrated circuit of claim 12 wherein said test voltage selection means comprises:

a first switch having a first terminal connected to a first voltage source that provides said first voltage level, a second terminal connected to the reference distribution node of at least one active pixel sensor on a row of active pixel sensors, and a control terminal connected to the controlling means to selectively connect and disconnect the first terminal with the second terminal;

a second switch having a first terminal connected to a second voltage source that provides said second voltage l vel, a s cond t rminal connected to the reference distribution node of at least one active pixel sensor on the row of active pixel sensors in the array of active pixel sensors, and a control terminal connected to the controlling means to selectively connect and disconnect the first terminal with the second terminal; and

a current measuring device connected so as to measure a current flowing from said first voltage source.

14. (Cancelled) The photo-imaging integrated circuit of claim 12 wherein the timing control means enables measurement of the capacitance of the photo-conversion device within one active pixel sensor by the steps of:

at a first time, selecting said active pixel sensor;

at a second time, placing the second voltage level at the reference distribution node of said active pixel sensor;

simultaneously, at the second time, coupling said second voltage level to the photo-conversion device;

at a third time, applying the first voltage level to the reference distribution nod ;

simultaneously, at the third time, coupling said first voltage level to said photo-conversion device;

measuring a current flowing to said photo-conversion device to charge the capacitance of the photo-conversion device, whereby said capacitance is determined by the formula:

$$C_{FD} = \frac{I}{dV/dt}$$

where

C_{FD} is the total capacitance of the photo-conversion devices and the parasitic capacitance of said test voltage select means,

I is the current flowing from said first voltage source,

dv is the difference between the first voltage level and the second voltage level, and

dt is a charging time for said capacitance;

15. (Cancelled) The photo-imaging integrated circuit of claim 12 wherein the timing control means enables testing functionality of a row of said active pixel sensors within the array of active pixel sensors and the chain of

circuitry connecting said selected row of active pixel sensors by the steps of:

at a first time, selecting said row of active pixel sensors;

at a second time, placing one of the plurality of voltage levels on each reference distribution node of each active pixel sensor, whereby a magnitude of said voltage level placed on each reference distribution node is indicative of a position on said row of active pixel sensors of each active pixel sensor;

simultaneously, at the second time, coupling the voltage level of the plurality of voltage levels to the photo-conversion device to charge the capacitance of the photo-conversion device to the voltage level;

at a third time, sampling and holding the voltage level of the capacitance of each active pixel sensor on the selected row of active pixel sensors within the signal conditioning and readout circuit;

at a fourth time, placing the first voltage level at the reference distribution node of each active pixel sensor on the row of active pixel sensors;

simultaneously, at the fourth time, coupling said first voltage level to the capacitance of the photo-conversion device of each active pixel sensor of the row of active pixel sensors;

at a fifth time, sampling and holding the first voltage level on the capacitance of the photo-conversion device of ach active pixel sensor on the selected row of active pixel sensors within the signal conditioning and readout circuit;

placing the sampled and held voltage level of the plurality of voltage levels and the sampled and held first voltage level of each active pixel sensor of the selected row of active pixel sensors at an output port of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external circuitry differentially compares the sampled and held voltage level of the plurality of voltage levels with the sampled and held first voltage level and the functionality of each active pixel sensor on the selected row of active pixel sensors, and the chain of circuitry connected to each active pixel sensor of the row of active pixel sensors is determined as a function of a difference between the sampled and held voltage level of the plurality of voltage levels and the sampled and held first voltage level.

16. (Cancelled) The photo-imaging integrated circuit of claim 12 wherein the timing and control means enables evaluating performance of at least one active pixel sensor and the chain of circuitry connected to said active pixel sensor by the steps of:

at a first time, selecting the active pixel sensor;

at a second time, placing the second voltage level at the reference distribution node of the active pixel sensor;

simultaneously, at the second time, coupling said second voltage level to the capacitance of said photo-conversion device;

at a third time, sampling and holding the second voltage level within the signal conditioning and readout circuit;

at a fourth time, placing the first voltage level at the reference distribution node of said active pixel sensor;

simultaneously, at the fourth time, coupling said first voltage level to the capacitance of the photo-conversion device;

at a fifth time, sampling and holding the first voltage level from said capacitance of said photo-conversion device of said active pixel sensor to the signal conditioning and readout circuit; and

placing the sampled and held first voltage level and the sampled and held second voltage level at an output of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external circuitry differentially compares the sampled and held first voltage level and the sampled and held second voltage level such that the difference of the sampled and held first voltage level and the sampled

and held second voltage level determines performance of the active pixel sensor.

17. (Cancelled) The photo-imaging integrated circuit of claim 12 wherein the test voltage selection means comprises:

a first voltage distribution line containing a first distribution voltage level;

a second voltage distribution line containing a second distribution voltage level;

a first switch having a first terminal connected to a first voltage source that provides the first voltage level, a second terminal connected to the first voltage distribution line, a third terminal connected to the second voltage distribution line, and a control terminal connected to the timing and control means to selectively connect the first terminal to the second and third terminals concurrently;

a second switch having a first terminal connected to a second voltage source that provides the second voltage level, a second terminal connected to the first voltage distribution line, a third terminal connected to the second voltage distribution line, and a control terminal connected to the timing and control means to selectively connect the first terminal to the second and third terminals concurrently;

a third switch having a first terminal connected to the first voltage source, a second terminal connected to the second voltag source, a third terminal connected to the first voltage distribution line, a fourth terminal connected to the second voltage distribution line, and a control terminal connected to the timing and control means to selectively connect the first terminal to the third terminal and concurrently connect the second terminal to the fourth terminal;

a voltage dividing means connected between the first voltage distribution line, and connected to the reference distribution node of each active pixel sensor on a row of active pixel sensors for the array of active pixel sensors for distributing an incremental voltage level that varies fractionally from the first distributed voltage level present at the first voltage distribution line to the second distributed voltage level present at the second voltage distribution line; and

a current measuring means connected so as to measure current flowing from said first voltage source.

18. (Cancelled) The photo-imaging integrated circuit of claim 17 wherein the timing and control means enables measurement of the capacitance of the photo-conversion device within a group of active pixel sensors of the array of active pixel sensors by the steps of:

at a first time, selecting said group of active pixel sensors;

during a period of time between a second time and a third time, activating said second switch to connect the first terminal of the second switch to connect the second terminal and third terminal of said second switch to apply the second voltage level to the first and second voltage distribution lines and thus to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period between said second time and said third time, coupling said second voltage level to the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to charge said capacitance to said second voltage level;

during a period of time between a fourth time and a fifth time, activating said first switch to connect the first terminal of said first switch concurrently to the second and third terminals of said first switch to apply the first voltage level to the first and second voltage distribution lines and thus to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period between the fourth and fifth time, coupling said first voltage level to the capacitance of the photo-conversion device of each active pixel sensor of the group of active

pixel sensors to charge said capacitance of said photo-conversion device to the first voltage level;

measuring a current flowing from said first voltage source to charge the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors, whereby a total capacitance of the photo-conversion devices of the group of active pixel sensors and a parasitic capacitance of said test voltage select means is determined by the formula:

$$C_T = \frac{I_T}{dV/dt_{CT}}$$

where

C_T is the total capacitance of the photo-conversion devices and the parasitic capacitance of said test voltage select means,

I_T is the current flowing from said first voltage source,

dv is the difference between the first voltage level and the second voltage level, and

dt_{CT} is a charging time for the total capacitance;

during a period of time between a sixth time and a seventh time, activating said second switch to connect the first terminal of the second switch to connect the second terminal and third terminal of said second switch to apply the second voltage level to the first and second voltage distribution lines and thus to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

during a period of time between an eighth time and a ninth time, activating said first switch to connect the first terminal of said first switch concurrently to the second and third terminals of said first switch to apply the first voltage level to the first and second voltage distribution lines and thus to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

measuring a current flowing from said first voltage source to charge the parasitic capacitance of said test voltage select means is determined by the formula:

$$C_P = \frac{I_P}{dV/dt_{CP}}$$

where

C_P is the parasitic capacitance of said test voltage select means,

I_P is the current flowing to the parasitic capacitance C_P during charging from the second voltage level to the first voltage level,

dv is a difference between the first voltage level and the second voltage level, and

dt_{CP} is a charging time for the parasitic capacitance,

such that an average capacitance of the photo-conversion device of each of said active pixel sensors of said group of active pixel sensors is determined by the formula:

$$\overline{C_{FD}} = \frac{C_T - C_P}{n}$$

where

$\overline{C_{FD}}$ is the average capacitance of the photodiode,

C_T is the total capacitance,

C_P is the parasitic capacitance, and

n is a number of active pixel sensors of the group of active pixel sensors.

19. (Cancelled) The photo-imaging integrated circuit of claim 17 wherein the timing and control means enables testing functionality of a group of at least one active pixel sensor by the steps of:

at a first time, selecting said group of active pixel sensors;

during a period of time between a second time and a third time, activating said third switch to apply said first voltage level to said first voltage distribution line and to apply said second voltage level to said second voltage distribution line such that one of the incremental voltage levels is applied to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period between the second and third time, coupling said incremental voltage level to the capacitance of the photo-conversion device of each active pixel sensor to the row of active pixel sensors to charge said capacitance of the photo-conversion device to the incremental voltage level;

during a period of time between a fourth time and a fifth time, sampling and holding within the signal conditioning and readout circuit the

incremental voltage level present on the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pixel sensors;

during a period of time between a sixth time and a seventh time, activating said first switch to apply the first voltage level to the first voltage distribution line and the second voltage distribution line to place the first voltage level at the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period of time between the sixth time and the seventh time, coupling said first voltage level from the reference distribution node to the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to charge said capacitance of the photo-conversion device from said incremental voltage level to said first voltage level;

during a period of time between an eighth time and a ninth time, sampling and holding within the signal conditioning and readout circuit said first voltage level present on said capacitance of said photo-conversion device of each active pixel sensor of the group of active pixel sensors;

placing the sampled and held incremental voltage level present of the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pix l sensors and th sampled and held

first voltage level of each of the active pixel sensors of the group of activ pixel sensors at an output port of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external circuitry differentially compares said sampled and held increment voltage level and said first voltage level, thus determining the functionality of each active pixel sensor of the group of active pixel sensors, and the chain of circuitry connected to each active pixel sensor of the group of active pixel sensors is determined as a function of a difference between the sampled and held incremental voltage level and the sampled and held first voltage level.

20. (Cancelled) The photo-imaging integrated circuit of claim 17 wherein the timing and control means enables evaluating performance of a group of at least one active pixel sensor of the array of active pixel sensors by the steps of:

at a first time, selecting said group of active pixel sensors;

during a period of time between a second time and a third time, activating said second switch to apply said second voltage level to said voltage distribution line such that said second voltage level is applied to the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period of time between the second and third time, coupling said second voltage level to the capacitance of the photo-conversion device of each active pixel sensor to the row of active pixel sensors to charge said capacitance of the photo-conversion device to the second voltage level;

during a period of time between a fourth time and a fifth time, sampling and holding within the signal conditioning and readout circuit the second voltage level present on the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pixel sensors;

during a period of time between a sixth time and a seventh time, activating said first switch to apply the first voltage level to the first voltage distribution line and the second voltage distribution line to place the first voltage level at the reference distribution node of each active pixel sensor of the group of active pixel sensors;

simultaneously, during the period of time between the sixth time and the seventh time, coupling said first voltage level from the reference distribution node to the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to charge said capacitance of the photo-conversion device from said incremental voltage level to said first voltage level;

during a period of time between an eighth time and a ninth time, sampling and holding within the signal conditioning and readout circuit said first voltage level present on said capacitance of each active pixel sensor of the group of active pixel sensors;

placing the sampled and held second voltage level present on the capacitance of the photo-conversion device of each of the active pixel sensors of the group of active pixel sensors and the sampled and held first voltage level of each of the active pixel sensors of the group of active pixel sensors at an output port of the signal conditioning and readout circuit for transfer to external circuitry, whereby the external circuitry differentially compares said sampled and held second voltage level and said first voltage level, thus determining performance of each active pixel sensor of the group of active pixel sensors and of the chain of circuitry connected to each active pixel sensor of the group of active pixel sensors is determined as a function of a difference between the sampled and held incremental voltage level and the sampled and held first voltage level.

21. (Cancelled) The photo-imaging integrated circuit of claim 20 wherein evaluating performance of each active pixel sensor of the group of active pixel sensors includes evaluating range and linearity of each active pixel sensor and the chain of circuitry connected to active pixel sensor.

22. (Cancelled) The photo-imaging integrated circuit of claim 20 wherein the group of active pixel sensors is a row of active pixel sensors placed in an area of dark pixels of the array of active pixel sensors.

23. (Original) A method for verifying operation of a group of at least one active pixel sensor within an array of active pixel sensors and of a chain of circuitry connected to each active pixel sensor for capturing an output signal from said active pixel sensor, whereby said chain of circuitry includes a column bus circuit and a signal conditioning and readout circuit, and whereby said method comprises the step of:

testing functionality of said group of active pixel sensors and the chain of circuitry connected to each active pixel sensor of the group of active pixel sensors by the steps of:

activating said group of active pixel sensors,

applying one of a group of voltage levels that vary incrementally from a first voltage level to charge a capacitance of a photo-conversion device of each active pixel sensor of the group of active pixel sensors to a first charging voltage level and sampling and holding said first charging voltage level from the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors,

applying the first voltage level to charge the capacitance of the photo-conversion device of each active pix l sensor of th group of active pixel sensors to a second charging voltage level,

sampling and holding a second charging voltage level from said capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors,

differentially comparing the first charging voltage level with the second charging voltage level to create a first difference voltage, whereby said first difference voltage indicates the functionality of each active pixel sensor of the group of active pixel sensors and the chain of circuitry connected to said active pixel sensor.

24. (Cancelled) A method for verifying operation of a group of at least one active pixel sensor within an array of active pixel sensors and of a chain of circuitry connected to each active pixel sensor for capturing an output signal from said active pixel sensor, whereby said chain of circuitry includes a column bus circuit and a signal conditioning and readout circuit, and whereby said method comprises the step of:

evaluating performance of said group of active pixel sensors and the chain of circuitry conn cted to each active pixel sensor of the group of active pixel sensors by the steps of:

activating said group of active pixel sensors ,

applying the second voltage level to charge a capacitance of a photo-conversion device of each active pixel sensor of the group of active pixel sensors to a third charging voltage level,

sampling and holding the third charging voltage level from said capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors,

applying the first voltage level to charge the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to a fourth charging voltage level,

sampling and holding the fourth charging voltage level from said capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors,

differentially comparing the third charging voltage level with the fourth charging voltage level to create a second difference voltage, whereby said second difference voltage indicates said performance of each active pixel sensor of the group of active pixel sensors and the chain of circuitry connected to said active pixel sensor.

25. (Cancelled) A method for verifying operation of a group of at least one active pixel sensor within an array of active pixel sensors and of a chain of circuitry connected to each active pixel sensor for capturing an output signal from said active pixel sensor, whereby said method comprises the step of:

determining an average capacitance of a photo-conversion device of each active pixel sensor of said group of active pixel sensors by the steps of:

applying a first voltage level to charge to a first voltage charging level a total capacitance including said capacitance of said photo-conversion device and a parasitic capacitance formed by interconnecting circuits between a voltage source and providing said first voltage level and said active pixel sensor,

applying a second voltage level provided by a second voltage source to charge from the first charging voltage level to a second charging voltage level said total capacitance,

measuring a current flowing into said total capacitance,

determining a first charging time for the first charging voltage level to charge to the second charging voltage level,

calculating the total capacitance by the formula:

$$C_T = \frac{I_T}{dV/dt_{CT}}$$

where

C_T is the total capacitance of the photo-conversion devices and the parasitic capacitance of said test voltage select means,

I_T is the current flowing from said first voltage source,

dv is the difference between the first voltage level and the second voltage level, and

dt_{CT} is a charging time for the total capacitance;

applying the first voltage level to the parasitic capacitance to charge said parasitic capacitance to a third charging voltage level,

applying the second voltage level to the parasitic capacitance to charge said parasitic capacitance from the third charging voltage level to a fourth charging voltage level,

measuring a current flowing into said parasitic capacitance,

determining a second charging time for the third charging voltag level to charge to th fourth charging voltag level,

calculating the parasitic capacitance by the formula:

$$C_P = \frac{I_P}{dV/dt_{CP}}$$

where

C_P is the parasitic capacitance of said test voltage select means,

I_P is the current flowing to the parasitic capacitance C_P during charging from the second voltage level to the first voltage level,

dv is a difference between the first voltage level and the second voltage level, and

dt_{CP} is a charging time for the parasitic capacitance,

determining the average capacitance of the photo-conversion device by the formula:

$$\overline{C_{FD}} = \frac{C_T - C_P}{n}$$

where

$\overline{C_{FD}}$ is the average capacitance of the photodiode,

C_T is the total capacitance,

C_P is the parasitic capacitance, and

n is a number of active pixel sensors of the group of active pixel sensors.

26. (Cancelled) A method for verifying operation of a group of at least one active pixel sensor within an array of active pixel sensors and of a chain of circuitry connected to each active pixel sensor for capturing an output signal from said active pixel sensor, whereby said chain of circuitry includes a column bus circuit and a signal conditioning and readout circuit, and whereby said method comprises the steps of:

testing functionality of said group of active pixel sensors and the chain of circuitry connected to each active pixel sensor of the group of active pixel sensors by comparing the difference between two voltage levels applied to charge a capacitance of a photo-conversion device of each

active pixel sensor to a first charging voltage level and a sampled and held first charging voltag level, whereby an amplitude of said sampled and held first charging voltage level determines the functionality of said active pixel sensors and said chain of circuitry;

evaluating performance of said groups of active pixel sensors and the chain of circuitry connected to each active pixel sensor of the group of active pixel sensors by comparing the difference between a first voltage level and a second voltage level applied at separate times to charge the capacitance of the photo-conversion device of each active pixel sensor to a second charging voltage level and a sampled and held second charging voltage level, whereby an amplitude of said sampled and held charging voltage level determines performance of said group of active pixel sensors; and

determining an average capacitance of each photo-conversion device of each active pixel sensor of the group of active pixel sensors by charging the capacitance between the first and the second voltage levels, measuring a charging current into said capacitance, measuring a charging time, and calculating said capacitance.

27. (Cancelled) The method of claim 26 wherein testing functionality comprises the steps of:

activating said group of active pixel sensors;

applying one of a group of voltage levels that vary incrementally from a first voltage l v l to charge a capacitance of a photo-conversion device of each active pixel sensor of the group of active pixel sensors to a first charging voltage level and sampling and holding said first charging voltage level from the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors;

applying the first voltage level to charge the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to a second charging voltage level;

sampling and holding a second charging voltage level from said capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors;

differentially comparing the first charging voltage level with the second charging voltage level to create a first difference voltage, whereby said first difference voltage indicates the functionality of each active pixel sensor of the group of active pixel sensors and the chain of circuitry connected to said active pixel sensor.

28. (Cancelled) The method of claim 26 wherein evaluating performance comprises the steps of:

activating said group of active pixel sensors ,

applying the second voltage level to charge a capacitance of a photo-conversion device of each active pixel sensor of the group of active pixel sensors to a third charging voltage level,

sampling and holding the third charging voltage level from said capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors,

applying the first voltage level to charge the capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors to a fourth charging voltage level,

sampling and holding the fourth charging voltage level from said capacitance of the photo-conversion device of each active pixel sensor of the group of active pixel sensors,

differentially comparing the third charging voltage level with the fourth charging voltage level to create a second difference voltage, whereby said second difference voltage indicates said performance of each active pixel sensor of the group of active pixel sensors and the chain of circuitry connected to said active pixel sensor.

29. (Cancelled) The method of claim 26 wherein determining average capacitance comprises the steps of:

applying a first voltage level to charge to a first voltage charging level a total capacitance including said capacitance of said photo-conversion device and a parasitic capacitance formed by interconnecting circuits between a voltage source and providing said first voltage level and said active pixel sensor,

applying a second voltage level provided by a second voltage source to charge from the first charging voltage level to a second charging voltage level said total capacitance,

measuring a current flowing into said total capacitance,

determining a first charging time for the first charging voltage level to charge to the second charging voltage level,

calculating the total capacitance by the formula:

$$C_T = \frac{I_T}{dV/dt_{CT}}$$

where

C_T is the total capacitance of the photo-conversion devices and the parasitic capacitance of said test voltage select means,

I_T is the current flowing from said first voltage source,

dv is the difference between the first voltage level and the second voltage level, and

dt_{CT} is a charging time for the total capacitance;

applying the first voltage level to the parasitic capacitance to charge said parasitic capacitance to a third charging voltage level,

applying the second voltage level to the parasitic capacitance to charge said parasitic capacitance from the third charging voltage level to a fourth charging voltage level,

measuring a current flowing into said parasitic capacitance,

determining a second charging time for the third charging voltage level to charge to the fourth charging voltage level,

calculating the parasitic capacitance by the formula:

$$C_P = \frac{I_P}{dV/dt_{CP}}$$

where

C_P is the parasitic capacitance of said test voltage select means,

I_P is the current flowing to the parasitic capacitance C_P during charging from the second voltage level to the first voltage level,

dv is a difference between the first voltage level and the second voltage level, and

dt_{CP} is a charging time for the parasitic capacitance,

determining the average capacitance of the photo-conversion device by the formula:

$$\overline{C_{FD}} = \frac{C_T - C_P}{n}$$

where

$\overline{C_{FD}}$ is the average capacitance of the photodiode,

C_T is the total capacitance,

C_P is the parasitic capacitance, and

n is a number of active pixel sensors of the group of active pixel sensors.

Please cancel Claims 1-22 and 24-29.